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PATENT AND TECHNICAL TRANSLATION

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*GERMAN AND FRENCH TO ENGLISH
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DECLARATION

The undersigned, Olaf Bexhoeft, hereby states that he is well acquainted with both the English and German languages and that the attached is a true translation to the best of his knowledge and ability of the German text of PCT/EP2004/013032, filed 11/17/2004, and published on 06/02/2005 as WO 2005/050330 A1.

The undersigned further declares that the above statement is true; and further, that this statement was made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or document or any patent resulting therefrom.

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Developer Unit

The invention relates to a developer unit with a toner supply and a toner application device, wherein toner is applied to a developer device, and wherein the toner can be brought into planar contact with an OPC.

Such a developer unit is known from EP 1 213 621 A. In this case the developer unit has an exchangeable toner supply reservoir, from which toner is metered into a developer housing. The toner is applied by means of an application roller to the surface of the developer roller. The developer roller rolls off on an OPC, namely a photo-conductor drum, and in the process transfers the toner material. The OPC is provided in a known manner with a latent charge image. The contact area between the developer roller and the OPC is embodied in the shape of a so-called "nip". Here, the rigid OPC surface penetrates into the elastically yielding surface of the developer roller. A planar contact area results accordingly, which has an extension in the circumferential surface of the OPC in a range of approximately 4 to 10 mm. The squeezed area between the OPC and the developer roller formed by this arrangement constitutes a non-defined deformation within which the circumferential velocity of the surface of the developer roller varies. In contrast to this the surface velocity of the OPC is constant. Because of

speed differences this can lead to smearing of the toner in the contact area. Moreover, because of the centrifugal force prevailing in the squeezed area, toner particles with a large inherent weight in particular can be prematurely released from the developer roller prior to the actual contact area. This leads to scattering effects, which impair the sharpness of the printed image.

It is the object of the invention to produce a developer unit of the type mentioned at the outset in which the toner transfer between the OPC and the developer device is improved.

This object is attained in that the developer device has a developer tape which is applied in the contact area to sections on the surface of the OPC.

With this arrangement a nip of a large extension in the circumferential direction of the OPC can be created between the OPC and the developer device. In the course of this, even toner particles which require a long dwell time in the contact area can be dependably transferred to the OPC. This developer unit is particularly suited for a qualitatively high-level transfer of ceramic toner. As a result of the enlarged embodiment of the nip in comparison with the prior art it is also possible to clearly increase the circumferential speed of the OPC and the developer device, and therefore the printing speed.

In accordance with a preferred embodiment of the invention it is provided that the developer tape is embodied as an endlessly revolving tape, which revolves around at least two deflection rollers, and that the contact area with the OPC is formed in the space between the deflection

rollers, and that at least one of the deflection rollers is placed against the OPC with the developer tape placed between them. In the process a predefined distance is created between the surfaces of the deflection rollers and of the OPC, within which the developer tape and the toner layer are arranged. In this connection it is possible, if required, to set a defined contact pressure for the OPC.

However, it is also conceivable for the contact area to be arranged at a distance from both deflection rollers. In this case no, or only minimal, centrifugal forces act on the toner. The danger that toner particles are inadvertently released is minimized with this. Moreover, with this embodiment an even contact pressure over the entire nip area is achieved.

For assisting the toner transfer it can be provided that a charging device is assigned to the contact area, by means of which an electrical charge can be applied to the toner. The charging device can be constituted by at least one corona device or at least one bias roller. The charging device is preferably arranged in the contact area between the contact points, at which the developer tape on the OPC and at a sufficient distance to these. In this way it is prevented that scattering effects are created outside of the contact area, which cause uncontrolled release of the toner.

In order to be able to always develop constant contact pressure forces between the developer tape and the OPC it is provided in accordance with a possible invention variation that a tape tensioning device is assigned to the developer tape. In this connection it is also particularly conceivable that a control unit is assigned to the tape tensioning device which adjusts the tape tensioning device as a function of a

predeterminable set point. In this case the tape tension can be specifically set, for example as a printing parameter. It is possible in this way to provide a match with the toner type employed and/or with the transferred image information.

To prevent toner residue on the developer tape following the transfer to the OPC, the developer tape has a surface roughness which is less in comparison with the toner element.

It is preferably provided in this connection that on its surface receiving the toner the developer tape has a surface roughness in the range of < 0.7 times of the d_{50vol} value of the toner used, in particular between 5 and 8 µm.

A conceivable invention alternative can be distinguished in that a metering roller rolls off the coated surface of the developer tape downstream of the application device and upstream of the contact area in the transport direction. In this connection it can be provided in particular that the metering roller rests against one of the deflection rollers with the developer tape placed between them. A defined gap area is created here between the metering roller and the deflection roller, in which the thickness of the toner layer on the developer tape can be exactly set. For an optimal coating of the developer tape it can also be provided that the toner application device is embodied as an application roller, which rolls off on one of the deflection rollers with the developer tape placed between them.

The invention will be explained in greater detail in what follows by means of an exemplary embodiment represented in the drawings. Shown are in:

Fig. 1, a lateral representation in a sectional view, a

portion of the developer unit with an assigned OPC, and

Fig. 2, in a schematic representation and in a lateral view, a developer tape of a developer unit with an assigned OPC.

Sections of a developer unit with a developer housing 20 are represented in Fig. 1. A toner cartridge, not represented in the drawings, is assigned to the developer housing 20. Toner powder is metered from it into the area between two mixing worms 21, 22 in the developer housing. Following the mixing worms, the toner powder reaches a toner application device 23, which is designed as an application roller in the present case. The application roller 23 rolls off on the surface of a developer tape 34. The application roller 23 transfers the toner powder in the process. The developer tape 34 is guided around two deflection rollers 31, 32, which are axis-parallel in respect to each other. Viewed in the transport direction, a metering roller 24 is arranged downstream of the application roller 23. It is arranged in the area of the deflection roller 32. It sees to it that the surface of the developer tape 34 is always supplied with toner of a constant thickness. The deflection roller 31 is used as a tensioning roller and can be displaced transversely to its axial direction. By means of this the developer tape 34 can be placed at a preset tape tension which, in one embodiment, can also be definitely set with the aid of electrostatic or electromagnetic actuation members.

At least one corona device or at least one bias roller is arranged as charging device 33 in the area between the two deflection rollers 31, 32.

As Fig. 1 shows, an OPC 10 which, in the present instance is designed as a photo-drum, is in contact with the

developer tape 34. In this case the developer tape 34 is looped around a portion of the circumference of the surface of the OPC 10. The loop area forms a contact area, the so-called "nip". This nip here extends between the two lines of contact in which the deflection rollers 31, 32 rest against the OPC 10. The charging device 33 is arranged between these lines of contact and at a distance from them. In the contact area it aids the transfer of the toner to the OPC 10.

The OPC 10 is designed in a known manner. The corona charging device 12, which brings the OPC to a charge level, is assigned to it. A latent charge image is generated by means of an LED writing head 13. Viewed in the direction of rotation, a cancellation lamp 11 is arranged upstream of the corona charging device. It completely discharges the OPC.

For performing a printing process, first a latent charge image is generated on the OPC 10. In the course of a rotation of the OPC 10, it is conducted to the developer unit. The deflection rollers 31, 32 are also simultaneously rotated and the developer tape 34 is evenly coated with toner via the application roller 23. As soon as the latent charge image reaches the contact area, the toner is transferred from the developer tape 34 to the OPC 10. Initially this occurs merely as a result of the charge difference between the OPC and the toner particles. The transfer is then actively aided in the area of the charging device 33.

To prevent scattering effects, the charge control can also be laid out in such a way that toner transfer takes place only in the area of the charging device 33.

At least one bias roller can be used as the charging device in place of the corona device shown in Fig. 1. It rolls off the developer tape 34 on the side facing away from

the OPC. In the course of this it is possible to apply a pressure force which aids the toner transfer in addition to the applied charging voltage.

The charging device 33 can also be employed via a control device for compensating the aging of the OPC 10. To this end it is possible to readjust the charging voltage in intervals or continuously.

An embodiment of the invention alternative to Fig. 1 is schematically represented in Fig. 2. In this case the OPC is arranged between the deflection rollers 31, 32 and without contact with them. A nip is formed in which the same forces act between the developer tape 34 and the OPC 10 over the entire contact area. Moreover, no centrifugal forces, which could lead to scattering effects, act on the toner in the nip area.